South Plains College-Reese Center
Course Syllabus

COURSE:	**RADR 1213-200 (2:2:0), Principles of Radiographic Imaging I**
SEMESTER:	**Fall 2024**
CLASS TIMES:	**MW, 8:30-9:45**
INSTRUCTOR:	**Clinton Bishop**
OFFICE:	**RC 512B**
OFFICE HOURS:	**M-F 09:00 – 11:00 & by appointment**
OFFICE PHONE:	**806-716-4629**
E-MAIL:	**cbishop@southplainscollege.edu**

"South Plains College improves each student's life."

GENERAL COURSE INFORMATION

It is the responsibility of each student to be familiar with the content and requirements listed in the course syllabus.

COURSE DESCRIPTION
This course focuses on radiographic image quality and the effects of exposure variables.

COURSE OBJECTIVES
This course will provide students with the technical information required to produce a diagnostic radiographic image and prepare the student for a meaningful clinical experience.

The student will:
1. Adhere to strict radiation protection standards using time, distance, and shielding for patient, visitor, staff and himself/herself.
2. Use the appropriate radiographic unit of measure when discussing radiation exposure and radiation dose.
3. Select and control radiographic exposure technique factors that will produce a beam of radiation capable of producing a diagnostic radiographic image.
4. Identify characteristics of electromagnetic radiation and explain their relationship to each other.
5. Differentiate between electromagnetic radiation and particulate radiation.
6. Describe the processes of x-radiation and heat production in the x-ray tube.
7. Identify the characteristics of a primary x-ray beam.
8. Describe the possible interactions between x-radiation and matter.
9. Select and control radiographic exposure technique factors that will produce a diagnostic radiographic image.
10. Assess radiographic images for diagnostic optical density, contrast, and recorded detail.
11. Analyze and adjust appropriate factors to obtain a diagnostic radiograph.

STUDENT LEARNING OUTCOMES
The student will:
1. Apply the basic principles of radiographic image acquisition to image quality, and analyze the effects of exposure variables upon image quality.
2. Control radiographic exposure and image production using the fundamental technical factors of kVp, mAs and SID.
3. Select appropriate technical factors and accessory equipment to enhance the radiographic exposure and image production.
4. Identify the characteristics of a diagnostic radiograph.
5. Assess radiographic images for optical density, contrast, and recorded detail.

EVALUATION METHODS
The course grade is determined by a combination of major exams and a comprehensive final exam.

ACADEMIC INTEGRITY

It is the aim of the faculty of South Plains College to foster a spirit of complete honesty and a high standard of integrity. The attempt of any student to present as his or her own any work which he or she has not honestly performed is regarded by the faculty and administration as a most serious offense and renders the offender liable to serious consequences, possibly suspension.

Cheating - Dishonesty of any kind on examinations or on written assignments, illegal possession of examinations, the use of unauthorized notes during an examination, obtaining information during an examination from the textbook or from the examination paper of another student, assisting others to cheat, alteration of grade records, illegal entry or unauthorized presence in the office are examples of cheating. Complete honesty is required of the student in the presentation of all phases of coursework. This applies to quizzes of whatever length, as well as final examinations, to daily reports and to term papers.

Plagiarism - Offering the work of another as one's own, without proper acknowledgment, is plagiarism; therefore, any student who fails to give credit for quotations or essentially identical expression of material taken from books, encyclopedias, magazines and other reference works, or from themes, reports or other writings of a fellow student, is guilty of plagiarism.

If found cheating or plagiarizing, the student's future in this program will be based on the decisions from the Allied Health Departmental Director's Committee.

BLACKBOARD

Blackboard is an e-Education platform designed to enable educational innovations everywhere by connecting people and technology. This educational tool will be used in this course throughout the semester.

The student should only access his or her own Blackboard account. Granting permission to another or accessing another student's Blackboard account is prohibited and against the Academic Integrity code.

SOCIAL MEDIA

Facebook: https://www.facebook.com/spcradtechprogram
Instagram: https://www.instagram.com/spcradtech/

SCANS and FOUNDATION SKILLS

Scans and foundation skills are identified for specific course objectives. A complete list explaining these skills is attached to the back of the syllabus for your information.

COVID

If you are experiencing any of the following symptoms, please do not attend class and either seek medical attention or get tested for COVID-19.

- Cough, shortness of breath, difficulty breathing
- Fever or chills
- Muscles or body aches
- Vomiting or diarrhea
- New loss of taste and smell

Please also notify DeEtte Edens, BSN, RN, Associate Director of Health & Wellness, at dedens@southplainscollege.edu or 806-716-2376.

SPECIFIC COURSE INFORMATION

REQUIRED TEXT AND MATERIALS
Bushong, S.C., Radiologic Science for Technologists – Physics, Biology, & Protection. 12th Edition. 2021. Elsevier.

ATTENDANCE POLICY (read carefully)
SPC - Students must attend all classes in order to be successful in a course. The student may be administratively withdrawn from the course when absences become excessive as defined in the course syllabus.

When an unavoidable reason for class absence arises, such as illness, an official trip authorized by the college or an official activity, the instructor may permit the student to make up work missed. It is the student's responsibility to complete work missed within a reasonable period of time as determined by the instructor. Students are officially enrolled in all courses for which they pay tuition and fees at the time of registration. Should a student, for any reason, delay in reporting to a class after official enrollment, absences will be attributed to the student from the first class meeting.

The Office of Admissions and Records will administratively drop students, who enroll in a course but have "Never Attended" by the official census date, as reported by the faculty member. A student who does not meet the attendance requirements of a class as stated in the course syllabus and does not officially withdraw from that course by the official census date of the semester, may be administratively withdrawn from that course and receive a grade of "X" or "F" as determined by the instructor. Instructors are responsible for clearly stating their administrative drop policy in the course syllabus, and it is the student's responsibility to be aware of that policy.

It is the student's responsibility to verify administrative drops for excessive absences through MySPC using his or her student online account. If it is determined that a student is awarded financial aid for a class or classes in which the student never attended or participated, the financial aid award will be adjusted in accordance with the classes in which the student did attend/participate and the student will owe any balance resulting from the adjustment.

SPC Radiologic Technology - Class attendance is mandatory. Students with 3 absences will be counseled. Students are allowed 5 absences during the fall semester. After the 5 absence, the student will be dropped from the program, regardless of the student's grade. Policies regarding absences coincide with those established for South Plains College as outlined in the SPC General Catalog.

An absence is an absence. The Radiologic Technology faculty do not distinguish between an excused and an unexcused absence.

It is extremely important to arrive for class **on time. Tardiness** disrupts the instructor and the other students. Students who chronically arrive late will be counseled. The student should be prepared for class at the scheduled class start time. **3 tardy will equal 1 absence.**

Students with perfect attendance and two or less tardy will be awarded 2 points to their final grade at the end of the semester.

DROPS AND WITHDRAWALS
http://www.southplainscollege.edu/admission-aid/apply/schedulechanges.php

ADVISING
http://www.southplainscollege.edu/admission-aid/advising/spcadvisors.php

INSTRUCTIONAL METHODS
The student will receive course information through a series of lectures, PowerPoint presentations, lab assignments, and textbook assignments.

CLASSROOM PARTICIPATION

Attending class regularly will provide the student opportunity to supplement their reading assignments and acquire a better understanding of the course material. Class time missed will result in information gaps and will increase course difficulty. It is the student's responsibility to attend class, which will enable him, or her to take notes, ask questions, and participate in class discussions. Information handouts may be given in certain instances, but the student should not rely on them. The student is encouraged to take adequate notes during class. Recording class is permitted.

ASSIGNMENT POLICY

The student is responsible for being prepared for class, which means reading the assigned chapters and/or pages from the textbook prior to class. The textbook is a mandatory requirement. **The student must bring the textbook/e-book to every class.** In some instances, information from the reading assignments not covered during class may be included on an exam.

COMPUTER USAGE

As computer technology in the field of health sciences continues to become more popular, computers will be used in this course for several assignments. All students will have access to open computer labs and printers on the South Plains College campus. Students will be expected to utilize computers to access assignments and classroom resources. All registered students are supplied with a working email account from South Plains College. In order to take exams, students must have their user name and password.
ALL STUDENTS ARE EXPECTED TO KNOW THEIR SPC STUDENT USER NAME AND PASSWORD.

COMPUTER LAB USAGE

The open computer lab(s) on any campus may be used by students during scheduled open hours or as assigned by an instructor. Printer paper will not be provided for students to print materials, but students may seek assistance from faculty or staff to request lab paper from the college if needed. Lack of computer lab paper is not an excuse for not having homework assignments, skills lab sheets, or any other required documents. Students should come prepared for class.

REVIEW

If a student needs assistance with reviewing any of the information giving during class or lab, the student is encouraged to make an appointment with the instructor.

CONFERENCES

If at any time a student is not satisfied with their overall performance, he/she is encouraged to schedule an appointment with me. If necessary, a plan can be developed to help the student improve in their areas of weakness.

GRADING RUBRIC

Grades in this course will be determined using the following criteria:

Assessment Tool	Assessment Criteria	Percentage Score	Grade
MAJOR EXAMS 70%	✓ Exceptional unit content knowledge & understanding	90 – 100	A
	✓ Good unit content knowledge & understanding	80 – 89	B
	✓ Average unit content knowledge & understanding	75 – 79	C
	✓ Insufficient unit content knowledge & understanding	0 – 74	F
FINAL EXAM 30%	✓ Exceptional course content knowledge & understanding	90 – 100	A
	✓ Good course content knowledge & understanding	80 – 89	B
	✓ Average course content knowledge & understanding	75 – 79	C
	✓ Insufficient unit content knowledge & understanding	0 – 74	F

Course Grade: A 90 – 100
B 80 – 89
C 75 – 79
F 0 – 74

A grade average of C (75) or higher is mandatory in all RADR classes. Failure to do so will result in the student being dropped from the Program.

Major Exams – 70% (4 exams, each worth 17.5%)

Major exams will be given throughout the semester following each module presented. Exams will be completed electronically in the computer lab.

The following guidelines will be followed regarding **Major Exams**:

1. The student will complete the exam at the scheduled time. **Make-up exams will be at the instructor's discretion.**
2. The student must complete the exam within the allotted class time of **75 minutes**.
3. If a major exam is missed, a zero will be recorded in the gradebook for that exam.
4. A student arriving late for an exam will not be allowed to take the exam if **any** student has completed the exam and left the room. This will also count as a tardy.
5. No cell phones, smartwatches, calculators, or other electronic assistance devices are allowed during exams.
6. Major exams are not available to print or save. Once you have finished your exam, please review the exam. Students may review exams in the instructor's office by appointment.

After TWO failed exams in a RADR course it is mandatory that the student:

- will meet with the instructor of that course and the Early Alert process will be initiated.
- will meet with an academic advisor/counselor before the next exam of that course.
- submit documentation to the instructor of the academic advisor/counselor meeting.

Final Exam – 30%

A comprehensive final exam will be given at the end of the semester. Two hours will be allotted for the final exam which will be completed electronically in the computer lab.

The following guidelines will be followed regarding the **Final Exam**:

1. The final exam will be comprehensive.
2. The final exam must be completed within the allotted time, **2 hours**.
3. A student arriving late for an exam will not be allowed to take the final exam if **any** student has completed the exam and left the room.
4. No cell phones, smartwatches, calculators, or other electronic assistance devices are allowed during final exam.
5. If the final exam is missed, a zero will be recorded in the gradebook for that exam.
6. The final exam is not available to print or save. Once you have finished your exam, please review the exam. Students may review the final exam in the instructor's office by appointment.

COMMUNICATION POLICY

Electronic communication between instructor and students in this course will utilize the South Plains College email system and GroupMe. Instructor will not initiate communication using private email accounts. Students are encouraged to check SPC email & GroupMe on a daily basis.

STUDENT CONDUCT

Students in this class are expected to abide by the standards of student conduct as defined in the SPC Student Guide and the Radiologic Technology Program Student Handbook.

Rules and regulations relating to the students at South Plains College are made with the view of protecting the best interests of the individual, the general welfare of the entire student body and the educational objectives of the college. As in any segment of society, a college community must be guided by standards that are stringent enough to prevent disorder, yet moderate enough to provide an atmosphere conducive to intellectual and personal development.
A high standard of conduct is expected of all students. When a student enrolls at South Plains College, it is assumed that the student accepts the obligations of performance and behavior imposed by the college relevant to its lawful missions, processes and functions. Obedience to the law, respect for properly constituted authority, personal honor, integrity and common sense guide the actions of each member of the college community both in and out of the classroom.
Students are subject to federal, state and local laws, as well as South Plains College rules and regulations. A student is not entitled to greater immunities or privileges before the law than those enjoyed by other citizens. Students are subject to such reasonable disciplinary action as the administration of the college may consider appropriate, including suspension and expulsion in appropriate cases for breach of federal, state or local laws, or college rules and regulations. This principle extends to conduct off-campus which is likely to have adverse effects on the college or on the educational process which identifies the offender as an unfit associate for fellow students.
Any student who fails to perform according to expected standards may be asked to withdraw.
Rules and regulations regarding student conduct appear in the current Student Guide.

CELL PHONES

Cellphones must be put away and are to be turned **OFF** or put on **silent** during scheduled class/lab periods, unless prior approval has been given from the instructor. Cell phones are to be used only outside of the classroom while class is in session. **This includes text messaging and/or internet browsing.**

Students will be dismissed from class/lab and sent home if a phone continuously rings/vibrates or if the student is discovered texting or browsing the internet. If dismissed from class, the student will receive an **absence** for the day. In case of emergencies, the student can also be reached by calling (806)716-4629 or (806)716-4628.

SPC SYLLABUS STATEMENTS (ACCOMMODATIONS)

https://www.southplainscollege.edu/syllabusstatements/

Introduction to the Imaging Sciences

The student will:

1. Identify major events in the discovery and advancement of x-ray imaging.
2. Identify the characteristics of matter and energy.
3. Identify the types of energy applicable to radiography.
   - Potential
   - Kinetic
   - Electrical
   - Thermal
4. Describe the use of time, distance and shielding for effective radiation protection. (F8, F9; C18, C19)
5. Use the radiologic units of measure.
   - Exposure: $Gray_{kerma}$
   - Absorbed dose: $Gray_{tissue}$
   - Dose Equivalent: Sievert
   - Radioactivity: Becquerel
6. Identify the basic particles of an atom: proton, neutron & electron.
7. Define atomic number and atomic mass number.
8. Describe binding energy as it applies to the atom's electron(s). (F10)
9. Identify the types of ionizing radiation.
10. Identify the principle particulate radiations: *alpha* particle, *positron* and *beta* particle.
11. Differentiate between electromagnetic and particulate radiation.

Structure of the Atom

The student will:

1. Relate the history of the atom.
2. Identify the structure of the atom.
3. Describe electron shells and instability with atomic structure.
4. Discuss radioactivity and the characteristics of alpha and beta particles.
5. Explain the difference between two forms of ionizing radiation: particulate and electromagnetic.

Electromagnetic and Particulate Radiation

The student will:

6. Define *photon*.
7. Identify the properties of electromagnetic (EM) photons, their relationship and how they affect interactions with matter. (F10, F12)
   - Velocity
   - Wavelength
   - Frequency
   - Energy
8. Identify the *speed of light*.
9. Calculate photon wavelength or frequency ($v = f\lambda$). (F4)
10. Identify the content of the *electromagnetic spectrum* and their arrangement pertinent to radiography.
    - Visible light, infrared light, ultraviolet light
    - Radiofrequency
    - Ionizing radiation
11. Differentiate between *x-radiation* and *gamma radiation*. (F12)
12. Explain the *wave-particle duality* of radiation. (F12)
13. Define the *Inverse Square Law*. (F12)

- $I_1/I_2 = (d_2/d_1)^2$ (F4)
- Inverse relationship with radiation intensity

14. Calculate radiation intensity using the Inverse Square Law formula. (F4)
15. Explain *ionization*.

The X-ray Tube

The student will:

1. Describe the general design of an x-ray tube.
2. List the external components that house and protect the x-ray tube.
3. Identify the purpose of the glass or metal enclosure.
4. Discuss the cathode and filament currents.
5. Describe the parts of the anode and the induction motor.
6. Define the line-focus principle and the heel effect.
7. Identify the three causes of x-ray tube failure.
8. Explain and interpret x-ray tube rating charts.

X-Ray Production

The student will:

1. Explain *thermionic emission, space charge* and *tube current*. (F10, C15)
2. Explain *heat production* and the factors that affect it. (F10; C15)
3. Explain *characteristic x-ray* production and the factors that affect it. (F10; C15)
4. Explain *bremsstrahlung x-ray* production and the factors that affect it. (F10; C15)
5. Identify the x-ray technical factors: milliamperage-seconds (mAs), kilovoltage-peak (kVp), filtration and source-to-image distance (SID) and explain their importance in x-ray production & emission.
6. Describe primary *x-ray beam quantity* and the effects of mAs, kVp, filtration and SID. (F10; C15)
7. Describe primary *x-ray beam quality* and the effects of kVp and filtration. (F10; C15)
8. Identify the information contained in a *continuous x-ray spectrum* and a *discrete x-ray spectrum*.
9. Anticipate how a change in any given technical factor will affect both forms of x-ray production. (F8, F9, F10, F12; C15)

Text Assignment: Bushong, Ch. 7

X-ray Emission

The student will:

1. Define *x-ray beam quantity* and relate it to x-ray intensity. (C15)
2. List and explain the technical factors that affect x-ray beam intensify: mAs, kVp, filtration, SID.
3. Use the *Square Law* to calculate a necessary mAs change when SID is altered. (F4, F12; C15)
   - $mAs_1/mAs_2 = (SID_1/SID_2)^2$
4. Define *x-ray beam quality (energy)* and relate it to x-ray penetration. (F12; C15)
5. List and explain the technical factors that affect x-ray beam quality: kVp, filtration and half-value layer (HVL).
6. Differentiate between the various types of filtration: inherent, added and compensating.

Text Assignment: Bushong, Ch. 8

X-ray Interaction with Matter

The student will:

1. Explain a *coherent (classical)* EM photon and matter interaction, including production, energy and effects. (F8, F10; C15)
2. Explain a *Compton* EM photon and matter interaction, including production, energy and effects. (F8, F10; C15)
3. Explain a *photoelectric* EM photon and matter interaction, including production, energy and effects. (F8, F10; C15)
4. Explain *pair production* and why it does not occur in diagnostic radiography. (F8, F10; C15)
5. Explain *photodisintegration* and why it does not occur in diagnostic radiography. (F8, F10; C15)
6. Explain why Compton and photoelectric interactions are important in radiologic technology. (F8, F10; C15)
7. Identify the interactions involved in differential absorption.(F10; C15)
8. Explain *differential absorption* in radiographic imaging. (F10)
9. Identify the factors that control and influence differential absorption. (C15)
10. Explain radiographic exponential attenuation of x-rays by matter. (F10)
11. Identify the components of the *remnant (exit) x-ray beam*.
12. Define *radiographic exposure*.
13. Describe the process of radiographic image formation. (F8, F10; C15)
    - Differential absorption
    - Beam attenuation
    - Scattering
    - Transmission

Text Assignment: Bushong, Ch. 9

Radiographic Image Quality

The student will:

1. Identify and define the properties that result in ***visibility of detail***. (F10)
    - Optical density
    - Contrast
2. Identify and define the properties of short scales of high contrast. (F10)
3. Identify and define the properties of long scales of low contrast. (F10)
4. Differentiate between ***radiographic contrast*** and ***subject contrast***. (C15)
5. Identify the effects of the primary radiographic technical factors on *visibility of detail*. (F12)
    - kVp
    - mAs = mA x exposure time
    - SID
    - Image receptor properties
6. Identify the effect of *scatter radiation* on the radiographic image. (F8, F9, F10)
7. Identify and define the properties that result in diagnostic ***recorded detail***. (F10)
8. Identify the radiographic geometric properties that affect recorded detail. (F10)
    - Focal spot size
    - SID
    - OID
9. Identify the key factors in producing the most diagnostic recorded detail.
10. Define radiographic distortion. (F10)
11. Differentiate between *radiographic size distortion and radiographic shape distortion*. (C15)
12. Identify and explain the effects of the components of ***radiographic exposure technique***.
    - **Primary technical factors:** mAs, kVp
    - **Secondary technical factors:** focal spot size, SID, OID, beam restriction, filters, grids, x-ray generators, central ray (CR) alignment.

Scatter Control

The student will:

1. Identify the x-rays that constitute image-forming radiation.
2. Recognize the relationship between scatter radiation and image contrast.
3. List three factors that contribute to scatter radiation.
4. Discuss three devices developed to minimize scatter radiation.
5. Describe beam restriction and its effect on patient radiation dose and image quality.
6. Describe grid constructions and its measures of performance.
7. Evaluate the use of various grids in relation to patient dose.

FOUNDATION SKILLS

BASIC SKILLS–Reads, Writes, Performs Arithmetic and Mathematical Operations, Listens and Speaks
F-1 Reading–locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules.
F-2 Writing–communicates thoughts, ideas, information and messages in writing and creates documents such as letters, directions, manuals, reports, graphs, and flow charts.
F-3 Arithmetic–performs basic computations; uses basic numerical concepts such as whole numbers, etc.
F-4 Mathematics–approaches practical problems by choosing appropriately from a variety of mathematical techniques.
F-5 Listening–receives, attends to, interprets, and responds to verbal messages and other cues.
F-6 Speaking–organizes ideas and communicates orally.

THINKING SKILLS–Thinks Creatively, Makes Decisions, Solves Problems, Visualizes and Knows How to Learn and Reason
F-7 Creative Thinking–generates new ideas.
F-8 Decision-Making–specifies goals and constraints, generates alternatives, considers risks, evaluates and chooses best alternative.
F-9 Problem Solving–recognizes problems, devises and implements plan of action.
F-10 Seeing Things in the Mind's Eye–organizes and processes symbols, pictures, graphs, objects, and other information.
F-11 Knowing How to Learn–uses efficient learning techniques to acquire and apply new knowledge and skills.
F-12 Reasoning–discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem.

PERSONAL QUALITIES–Displays Responsibility, Self-Esteem, Sociability, Self-Management, Integrity and Honesty
F-13 Responsibility–exerts a high level of effort and perseveres towards goal attainment.
F-14 Self-Esteem–believes in own self-worth and maintains a positive view of self.
F-15 Sociability–demonstrates understanding, friendliness, adaptability, empathy and politeness in group settings.
F-16 Self-Management–assesses self accurately, sets personal goals, monitors progress and exhibits self-control.
F-17 Integrity/Honesty–chooses ethical courses of action.

SCANS COMPETENCIES

C-1 **TIME** - Selects goal - relevant activities, ranks them, allocates time, prepares and follows schedules.
C-2 **MONEY** - Uses or prepares budgets, makes forecasts, keeps records and makes adjustments to meet objectives.
C-3 **MATERIALS AND FACILITIES** - Acquires, stores, allocates, and uses materials or space efficiently.
C-4 **HUMAN RESOURCES** - Assesses skills and distributes work accordingly, evaluates performances and provides feedback.

INFORMATION - Acquires and Uses Information
C-5 Acquires and evaluates information.
C-6 Organizes and maintains information.
C-7 Interprets and communicates information.
C-8 Uses computers to process information.

INTERPERSONAL–Works With Others
C-9 Participates as a member of a team and contributes to group effort.
C-10 Teaches others new skills.
C-11 Serves Clients/Customers–works to satisfy customer's expectations.
C-12 Exercises Leadership–communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies.

C-13 Negotiates-works toward agreements involving exchanges of resources; resolves divergent interests.
C-14 Works With Diversity–works well with men and women from diverse backgrounds.

SYSTEMS–Understands Complex Interrelationships
C-15 Understands Systems–knows how social, organizational, and technological systems work and operates effectively with them.
C-16 Monitors and Corrects Performance–distinguishes trends, predicts impacts on system operations, diagnoses systems performance and corrects malfunctions.
C-17 Improves or Designs Systems–suggests modifications to existing systems and develops new or alternative systems to improve performance.

TECHNOLOGY–Works with a Variety of Technologies
C-18 Selects Technology–chooses procedures, tools, or equipment, including computers and related technologies.
C-19 Applies Technology to Task–understands overall intent and proper procedures for setup and operation of equipment.
C-20 Maintains and Troubleshoots Equipment–prevents, identifies, or solves problems with equipment, including computers and other technologies.